

I claim:

- 1 1. A compressive structural element comprising:
2 an enclosure having walls surrounding a cavity;
3 and
4 a non-compressible material disposed in the
5 cavity; wherein
6 the walls are shaped such that a first
7 compressive force tending to compress the element by a
8 first deflection causes an amplified second deflection
9 of the walls into the non-compressible material,
10 exerting a second compressive force against the non-
11 compressible material, resulting in a resistance to
12 the first deflection and the first compressive force
13 tending to compress the element.
- 1 2. The compressive structural element of claim 1,
2 wherein the walls are concavely shaped.
- 1 3. The compressive structural element of claim 1,
2 wherein the walls are of a uniform thickness such that
3 the second deflection causes minimal migration of the
4 non-compressible material.

1 4. The compressive structural element of claim 1,
2 wherein the walls gradually become thicker at the
3 center of the cavity such that the second deflection
4 causes increased migration of the non-compressible
5 material.

1 5. The compressive structural element of claim 1,
2 wherein the non-compressible material is an elastomer.

1 6. The compressive structural element of claim 1,
2 wherein the non-compressible material is a liquid.

1 7. The compressive structural element of claim 1,
2 wherein the non-compressible material is a combination
3 of elastomer and liquid.

1 8. A tensile structural element comprising:
2 an enclosure having walls surrounding a cavity;
3 and
4 a non-compressible material disposed in the
5 cavity; wherein
6 the walls are shaped such that a tensile force
7 tending to elongate the element by a first deflection

8 causes an amplified second deflection of the walls
9 into the non-compressible material, exerting a
10 compressive force against the non-compressible
11 material, resulting in a resistance to the first
12 deflection and the tensile force tending to elongate
13 the element.

1 9. The tensile structural element of claim 8,
2 wherein the walls are convexly shaped.

1 10. The tensile structural element of claim 8,
2 wherein the walls are of a uniform thickness such that
3 the second deflection causes minimal migration of the
4 non-compressible material.

1 11. The tensile structural element of claim 8,
2 wherein the walls gradually become thicker at the
3 center of the cavity such that the second deflection
4 causes increased migration of the non-compressible
5 material.

1 12. The tensile structural element of claim 8,
2 wherein the non-compressible material is an elastomer.

1 13. The tensile structural element of claim 8,
2 wherein the non-compressible material is a liquid.

1 14. The compressive structural element of claim 8,
2 wherein the non-compressible material is a combination
3 of elastomer and liquid.

1 15. A structural element comprising:
2 compressive and tensile structural elements
3 the compressive structural element having a first
4 enclosure having first walls surrounding a first
5 cavity;
6 the tensile structural element having a second
7 enclosure having second walls surrounding a second
8 cavity;
9 a first non-compressible material disposed in the
10 first cavity; and
11 a second non-compressible material disposed in
12 the second cavity; wherein
13 the first walls are shaped such that a first
14 force tending to compress the structural element by a
15 first deflection causes an amplified second deflection
16 of the first walls into the first non-compressible

17 material, exerting a first compressive force against
18 the first non-compressible material, resulting in a
19 resistance to the first deflection and the first force
20 tending to compress the structural element; and

21 the second walls are shaped such that a second
22 force tending to elongate the structural element by a
23 third deflection causes an amplified fourth deflection
24 of the second walls into the second non-compressible
25 material, exerting a second compressive force against
26 the second non-compressible material, resulting in a
27 resistance to the third deflection and the second
28 force tending to elongate the structural element.

1 16. The structural element of claim 15, wherein at
2 least one of the first walls surrounding the first
3 cavity also comprises at least one of the second walls
4 surrounding the second cavity.

1 17. The structural element of claim 15, wherein the
2 first walls are concavely shaped.

1 18. The structural element of claim 15, wherein the
2 second walls are convexly shaped.

1 19. The structural element of claim 15, wherein the
2 first and second walls are of a uniform thickness such
3 that the second or fourth deflection causes minimal
4 migration of the first and second non-compressible
5 materials, respectively.

1 20. The structural element of claim 15, wherein the
2 first and second walls gradually become thicker at the
3 center of the first and second cavities such that the
4 second or fourth deflection causes increased migration
5 of the first and second non-compressible materials,
6 respectively.

1 21. The structural element of claim 15, wherein at
2 least one of the first and second non-compressible
3 materials is an elastomer.

1 22. The structural element of claim 15, wherein at
2 least one of the first and second non-compressible
3 materials is a liquid.

1 23. The structural element of claim 15, wherein at

2 least one of the first and second non-compressible
3 materials is a combination of elastomer and liquid.

1 24. A compressive structural element comprising;
2 a cylindrical enclosure having a wall, a top, a
3 bottom, and a cavity defined by the wall, top and
4 bottom, the top and bottom being separated by a
5 height; and
6 a non-compressible material disposed in the
7 cavity; wherein
8 the walls are concavely shaped such that a first
9 compressive force tending to decrease the height
10 causes an amplified deflection of the wall into the
11 non-compressible material, exerting a second
12 compressive force against the non-compressible
13 material, resulting in a resistance to the amplified
14 deflection and the first compressive force.

1 25. The compressive structural element of claim 24,
2 wherein the wall, top and bottom comprise an integral
3 shell surrounding the non-compressible material
4 disposed in the cavity.

1 26. The compressive structural element of claim 25,
2 wherein the wall comprises a plurality of panels
3 separated by flectural joints for aiding the
4 deflection of the wall into the non-compressible
5 material.

1 27. The compressive structural element of claim 25,
2 wherein the shell is a metal.

1 28. The compressive structural element of claim 24
2 wherein the wall is of a uniform thickness such that
3 the amplified deflection causes minimal migration of
4 the non-compressible material.

1 29. The compressive structural element of claim 24,
2 wherein the wall gradually becomes thicker at the
3 center of the cavity such that the amplified
4 deflection causes increased migration of the non-
5 compressible material.

1 30. The compressive structural element of claim 24,
2 wherein the non-compressible material is an elastomer.

1 31. The compressive structural element of claim 24,
2 wherein the non-compressible material is a liquid.

1 32. The compressive structural element of claim 24,
2 wherein the non-compressible material is a combination
3 of elastomer and liquid.

1 33. A tensile structural element comprising;
2 a cylindrical enclosure having a wall, a top, a
3 bottom, and a cavity defined by the wall, top and
4 bottom, the top and bottom being separated by a
5 height; and
6 a non-compressible material disposed in the
7 cavity; wherein
8 the walls are convexly shaped such that a tensile
9 force tending to increase the height causes an
10 amplified deflection of the wall into the non-
11 compressible material, exerting a compressive force
12 against the non-compressible material, resulting in a
13 resistance to the amplified deflection and the tensile
14 force.

1 34. The tensile structural element of claim 33,

2 wherein the wall, top and bottom comprise an integral
3 shell surrounding the non-compressible material
4 disposed in the cavity.

1 35. The tensile structural element of claim 34,
2 wherein the shell is a metal.

1 36. The tensile structural element of claim 33,
2 wherein the wall comprises a plurality of panels
3 separated by flectural joints for aiding the
4 deflection of the wall into the non-compressible
5 material.

1 37. The tensile structural element of claim 33,
2 wherein the wall is of a uniform thickness such that
3 the amplified deflection causes minimal migration of
4 the non-compressible material.

1 38. The tensile structural element of claim 33,
2 wherein the wall gradually becomes thicker at the
3 center of the cavity such that the amplified
4 deflection causes increased migration of the non-
5 compressible material.

1 39. The tensile structural element of claim 33,
2 wherein the non-compressible material is an elastomer.

1 40. The tensile structural element of claim 33,
2 wherein the non-compressible material is a liquid.

1 41. The compressive structural element of claim 33,
2 wherein the non-compressible material is a combination
3 of elastomer and liquid.

1 42. A structural beam comprising;
2 an upper surface in compression due to a loading
3 force;

4 a lower surface in tension due to the loading
5 force;

6 means for connecting the upper and lower
7 surfaces;

8 a plurality of compressive structural elements
9 disposed along the length of the upper surface, each
10 compressive structural element comprising a first
11 enclosure having first walls surrounding a first
12 cavity, and a first non-compressible material disposed

13 in the first cavity, wherein the first walls are
14 shaped such that the loading force tends to compress
15 the compressive structural element by a first
16 deflection causing an amplified second deflection of
17 the first walls into the first non-compressible
18 material, exerting a compressive force against the
19 first non-compressible material, resulting in a
20 resistance to the first deflection and the loading
21 force; and

22 a plurality of tensile structural elements
23 disposed along the length of the lower surface, each
24 tensile structural element comprising a second
25 enclosure having second walls surrounding a second
26 cavity, and a second non-compressible material
27 disposed in the second cavity, wherein the second
28 walls are shaped such that the loading force tends to
29 elongate the tensile structural element by a third
30 deflection causing an amplified fourth deflection of
31 the second walls into the second non-compressible
32 material, exerting a compressive force against the
33 second non-compressible material, resulting in a
34 resistance to the third deflection and the loading
35 force.

1 43. The structural beam of claim 42, wherein the
2 shape of the beam is an I-beam and the means for
3 connecting the upper and lower surfaces is a web.

1 44. The structural beam of claim 42, wherein the
2 first and second walls are of a uniform thickness such
3 that the second and fourth deflections causes minimal
4 migration of the first and second non-compressible
5 materials, respectively.

1 45. The structural beam of claim 42, wherein the
2 first and second walls gradually become thicker at the
3 center of the first and second cavities, such that the
4 second and fourth deflections causes increased
5 migration of the first and second non-compressible
6 materials, respectively.

1 46. The tensile structural element of claim 42,
2 wherein at least one of the first and second non-
3 compressible materials is an elastomer.

1 47. The tensile structural element of claim 42,

2 wherein at least one of the first and second non-
3 compressible materials is a liquid.

1 48. The compressive structural element of claim 42,
2 wherein at least one of the first and second non-
3 compressible materials is a combination of elastomer
4 and liquid.

1 49. A structural beam comprising;
2 an upper surface in one of compression or tension
3 due to a loading force;
4 a lower surface in the other of compression or
5 tension due to the loading force;
6 means for connecting the upper surface to the
7 lower surface; and
8 a plurality of structural elements disposed along
9 the length of the upper and lower surfaces, each
10 structural element comprising a compressive and a
11 tensile structural element, the compressive structural
12 element having a first enclosure having first walls
13 surrounding a first cavity, the tensile structural
14 element having a second enclosure having second walls
15 surrounding a second cavity, a first non-compressible

16 material disposed in the first cavity, and a second
17 non-compressible material disposed in the second
18 cavity, wherein the first walls are shaped such that
19 the loading force tends to compress the structural
20 element by a first deflection causing an amplified
21 second deflection of the first walls into the first
22 non-compressible material, exerting a first
23 compressive force against the first non-compressible
24 material, resulting in a resistance to the first
25 deflection and the loading force, and wherein the
26 second walls are shaped such that the loading force
27 tends to elongate the structural element by a third
28 deflection causing an amplified fourth deflection of
29 the second walls into the second non-compressible
30 material, exerting a second compressive force against
31 the second non-compressible material, resulting in a
32 resistance to the third deflection and the loading
33 force.

1 50. The structural beam of claim 49, wherein the
2 shape of the beam is an I-beam and the means for
3 connecting the upper and lower surfaces is a web.

1 51. The structural beam of claim 49, wherein the
2 first and second walls are of a uniform thickness such
3 that the second and fourth deflections causes minimal
4 migration of the first and second non-compressible
5 materials, respectively.

1 52. The structural beam of claim 49, wherein the
2 first and second walls gradually become thicker at the
3 center of the first and second cavities, such that the
4 second and fourth deflections causes increased
5 migration of the first and second non-compressible
6 materials, respectively.

1 53. The structural beam of claim 49, wherein at least
2 one of the first and second non-compressible materials
3 is an elastomer.

1 54. The structural beam of claim 49, wherein at least
2 one of the first and second non-compressible materials
3 is a liquid.

1 55. The structural beam of claim 49, wherein at least
2 one of the first and second non-compressible materials

is a combination of elastomer and liquid.

1 56. A structural beam comprising:
2 an upper surface;
3 a lower surface;
4 a first and second wall connecting the upper and
5 lower surface, the volume between the walls defining a
6 cavity; and
7 a non-compressible material disposed in the
8 cavity; wherein
9 the walls are shaped such that a first
10 compressive force tending to compress the beam by a
11 first deflection causes an amplified second deflection
12 of the walls into the non-compressible material,
13 exerting a second compressive force against the non-
14 compressible material, resulting in a resistance to
15 the first deflection and the force tending to compress
16 the beam.

1 57. The structural beam of claim 56, wherein the
2 shape of the beam is an I-beam.

1 58. The structural beam of claim 56, wherein the

2 walls are concavely shaped.

1 59. The structural beam of claim 56, wherein the
2 walls are of a uniform thickness such that the second
3 deflection causes minimal migration of the non-
4 compressible material.

1 60. The structural beam of claim 56, wherein the
2 walls gradually become thicker at the center of the
3 cavity such that the second deflection causes
4 increased migration of the non-compressible material.

1 61. The tensile structural element of claim 56,
2 wherein the non-compressible material is an elastomer.

1 62. The tensile structural element of claim 56,
2 wherein the non-compressible material is a liquid.

1 63. The compressive structural element of claim 56,
2 wherein the non-compressible material is a combination
3 of elastomer and liquid.

1 64. A structural beam having a cross-sectional

2 profile, first portions of the profile being in ,
3 compression and second portions of the profile being
4 in tension due to a loading force, the beam
5 comprising:

6 a multiplicity of compressive structural elements
7 disposed throughout the cross-sectional profile in the
8 portions in compression, each compressive structural
9 element comprising a first enclosure having first
10 walls surrounding a first cavity, and a first non-
11 compressible material disposed in the first cavity,
12 wherein the first walls are shaped such that the
13 compressive force due to the loading force tends to
14 compress the compressive structural element by a first
15 deflection causing an amplified second deflection of
16 the first walls into the first non-compressible
17 material, exerting a compressive force due to the
18 second deflection against the first non-compressible
19 material, resulting in a resistance to the first
20 deflection and the loading force; and

21 a multiplicity of tensile structural elements
22 disposed throughout the cross-sectional profile in the
23 portions in tension, each tensile element comprising a
24 second enclosure having second walls surrounding a

25 second cavity, and a second non-compressible material
26 disposed in the second cavity, wherein the second
27 walls are shaped such that the tensile force due to
28 the loading force tends to elongate the tensile
29 structural element by a third deflection causing an
30 amplified fourth deflection of the second walls into
31 the second non-compressible material, exerting a
32 compressive force due to the fourth deflection against
33 the second non-compressible material, resulting in a
34 resistance to the third deflection and the loading
35 force.

1 65. The structural beam of claim 64, wherein the
2 first structural elements are of greater incidence in
3 portions of greatest compression, and wherein the
4 second structural elements are of greater incidence in
5 portions of greatest tension.

1 66. The structural beam of claim 64, wherein the
2 shape of the beam is an I-beam, having an upper flange
3 in compression, a lower flange in tension, and a web
4 connecting the upper and lower flanges, and wherein
5 the portions of greatest compression is in the upper

6 flange, and the portions of greatest tension is in the
7 lower flange.

1 67. The structural beam of claim 64, wherein the
2 first and second walls are of a uniform thickness such
3 that the second and fourth deflections causes minimal
4 migration of the first and second non-compressible
5 materials, respectively.

1 68. The structural beam of claim 64, wherein the
2 first and second walls gradually become thicker at the
3 center of the first and second cavities, such that the
4 second and fourth deflections causes increased
5 migration of the first and second non-compressible
6 materials, respectively.

1 69. The tensile structural element of claim 64,
2 wherein at least one of the first and second non-
3 compressible materials is an elastomer.

1 70. The tensile structural element of claim 64,
2 wherein at least one of the first and second non-
3 compressible materials is a liquid.

1 71. The tensile structural element of claim 64,
2 wherein at least one of the first and second non-
3 compressible materials is a combination of elastomer
4 and liquid.

1 72. A structural beam having a cross-sectional
2 profile, first portions of the profile being in
3 compression and second portions of the profile being
4 in tension due to a loading force, the beam
5 comprising:
6 a multiplicity of structural elements disposed
7 throughout the cross-sectional profile of the beam,
8 each structural element comprising a compressive and a
9 tensile structural element, the compressive structural
10 element having a first enclosure having first walls
11 surrounding a first cavity, the tensile structural
12 element having a second enclosure having second walls
13 surrounding a second cavity, a first non-compressible
14 material disposed in the first cavity, and a second
15 non-compressible material disposed in the second
16 cavity, wherein the first walls are shaped such that
17 the loading force tends to compress the structural

18 element by a first deflection causing an amplified
19 second deflection of the first walls into the first
20 non-compressible material, exerting a first
21 compressive force against the first non-compressible
22 material, resulting in a resistance to the first
23 deflection and the loading force, and wherein the
24 second walls are shaped such that the loading force
25 tends to elongate the structural element by a third
26 deflection causing an amplified fourth deflection of
27 the second walls into the second non-compressible
28 material, exerting a second compressive force against
29 the second non-compressible material, resulting in a
30 resistance to the third deflection and the loading
31 force.

1 73. The structural beam of claim 72, wherein the
2 structural elements are of greater incidence in
3 portions of greatest compression and greatest tension.

1 74. The structural beam of claim 73, wherein the
2 shape of the beam is an I-beam, having an upper flange
3 in compression, a lower flange in tension, and a web
4 connecting the upper and lower flanges, and wherein

5 the portions of greatest compression is in the upper
6 flange, and the portions of greatest tension is in the
7 lower flange.

1 75. The structural beam of claim 72, wherein the
2 first and second walls are of a uniform thickness such
3 that the second and fourth deflections causes minimal
4 migration of the first and second non-compressible
5 materials, respectively.

1 76. The structural beam of claim 72, wherein the
2 first and second walls gradually become thicker at the
3 center of the first and second cavities, such that the
4 second and fourth deflections causes increased
5 migration of the first and second non-compressible
6 materials, respectively.

1 77. The structural beam of claim 72, wherein at least
2 one of the first and second non-compressible materials
3 is an elastomer.

1 78. The structural beam of claim 72, wherein at least
2 one of the first and second non-compressible materials

3 is a liquid.

1 79. The structural beam of claim 72, wherein at least
2 one of the first and second non-compressible materials
3 is a combination of elastomer and liquid.

1 80. A motion impartation device comprising;
2 a driving portion;
3 a driven portion engaged with the driving portion
4 such that a gap separates the driving portion from the
5 driven portion; and
6 a structural element disposed in each gap such
7 that a first compressive force is transferred from the
8 driven portion to the driving portion and a tensile
9 force is transferred from the driven portion to the
10 driving portion, each structural element comprising a
11 compressive and a tensile structural element, the
12 compressive structural element having a first
13 enclosure having first walls surrounding a first
14 cavity, the tensile structural element having a second
15 enclosure having second walls surrounding a second
16 cavity, a first non-compressible material disposed in
17 the first cavity, and a second non-compressible

18 material disposed in the second cavity, wherein the
19 first walls are shaped such that the compression force
20 tends to compress the compressive structural element
21 by a first deflection causing an amplified second
22 deflection of the first walls into the first non-
23 compressible material, exerting a second compressive
24 force against the first non-compressible material,
25 resulting in a resistance to the first deflection and
26 the first compressive force, and wherein the second
27 walls are shaped such that the tensile force tends to
28 elongate the structural element by a third deflection
29 causing an amplified fourth deflection of the second
30 walls into the second non-compressible material,
31 exerting a third compressive force against the second
32 non-compressible material, resulting in a resistance
33 to the third deflection and the tensile force.

1 81. The motion impartation device of claim 80,
2 wherein the device is a coupling for imparting
3 rotation from a driving shaft to a driven shaft, the
4 driving shaft being connected to the driving portion
5 and the driven shaft being connected to the driven
6 portion, the driving and driven portions each having a

7 plurality of teeth, the teeth being meshingly engaged
8 wherein the structural elements are disposed in gaps
9 between the teeth of the driven portion and the teeth
10 of the driving portion.

1 82. The motion impartation device of claim 80,
2 wherein the device is a coupling for imparting
3 translation of the driven portion to the driving
4 portion, the driving and driven portions each having a
5 plurality of teeth, the teeth being meshingly engaged
6 wherein the structural elements are disposed in gaps
7 between the teeth of the driven portion and the teeth
8 of the driving portion.

1 83. The motion impartation device of claim 80,
2 wherein the first and second walls are of a uniform
3 thickness such that the second and fourth deflections
4 causes minimal migration of the first and second non-
5 compressible materials, respectively.

1 84. The motion impartation device of claim 80,
2 wherein the first and second walls gradually become
3 thicker at the center of the first and second

4 cavities, such that the second and fourth deflections
5 causes increased migration of the first and second
6 non-compressible materials, respectively.

1 85. The motion impartation device of claim 80,
2 wherein at least one of the first and second non-
3 compressible materials is an elastomer.

1 86. The motion impartation device of claim 80,
2 wherein at least one of the first and second non-
3 compressible materials is a liquid.

1 87. The motion impartation device of claim 80,
2 wherein at least one of the first and second non-
3 compressible materials is a combination of elastomer
4 and liquid.

1 88. A method for fabricating a structural beam having
2 a cross-sectional profile, first portions of the
3 profile being in compression and second portions of
4 the profile being in tension due to a loading force,
5 the beam also having compressive and tensile
6 structural elements, each compressive structural

7 element comprising a first enclosure having first
8 walls surrounding a first cavity, and a first non-
9 compressible material disposed in the first cavity,
10 wherein the first walls are shaped such that the
11 compressive force due to the loading force tends to
12 compress the compressive structural element by a first
13 deflection causing an amplified second deflection of
14 the first walls into the first non-compressible
15 material, exerting a compressive force due to the
16 second deflection against the first non-compressible
17 material, resulting in a resistance to the first
18 deflection and the loading force, and each tensile
19 element comprising a second enclosure having second
20 walls surrounding a second cavity, and a second non-
21 compressible material disposed in the second cavity,
22 wherein the second walls are shaped such that the
23 tensile force due to the loading force tends to
24 elongate the tensile structural element by a third
25 deflection causing an amplified fourth deflection of
26 the second walls into the second non-compressible
27 material, exerting a compressive force due to the
28 fourth deflection against the second non-compressible
29 material, resulting in a resistance to the third

30 deflection and the loading force, the method
31 comprising the steps of;
32 providing compressive structural elements of the
33 present invention;
34 providing tensile structural elements of the
35 present invention;
36 forming the cross-sectional profile of the beam
37 to a predetermined length; and
38 disposing a multiplicity of the compressive and
39 tensile structural elements throughout the beam cross-
40 sectional profile and along its length.

1 89. The method of claim 88, wherein the providing
2 steps further include the sub-steps of:
3 fabricating the first non-compressible material
4 to a shape and size substantially similar to that of
5 the first cavity;
6 fabricating the second non-compressible material
7 to a shape and size substantially similar to that of
8 the second cavity;
9 forming the first enclosures having first walls,
10 around the first non-compressible material; and
11 forming the second enclosures having second

12 walls, around the second non-compressible material.

1 90. The method of claim 89, wherein the steps of
2 fabricating the first and second non-compressible
3 materials are performed by injection molding, wherein
4 the non-compressible material is an elastomer.

1 91. The method of claim 89, wherein the steps of
2 forming the first and second enclosures around their
3 respective first and second non-compressible materials
4 are performed by spraying a metal shell onto the first
5 and second non-compressible materials.

1 92. The method of claim 89, wherein the steps of
2 forming the first and second enclosures around their
3 respective first and second non-compressible materials
4 are performed by dipping the elastomer into a liquid
5 material bath which hardens to form a shell around the
6 first and second non-compressible materials.

1 93. The method of claim 88, wherein the providing
2 steps further include the sub-steps of:

3 forming the first enclosure;
4 forming the second enclosure;
5 filling the first enclosure with the first non-
6 compressible material; and
7 filling the second enclosure with the second non-
8 compressible material.

1 94. The method of claim 88, wherein the step of
2 disposing a multiplicity of the compressive and
3 tensile structural elements throughout the beam cross-
4 sectional profile and along its length further
5 includes the sub-steps of:
6 weighting the greatest incidence of compressive
7 structural elements in portions of greatest
8 compression; and
9 weighting the greatest incidence of tensile
10 structural elements in portions of greatest tension.

1 95. The method of claim 94, wherein the weighting
2 sub-steps comprise:
3 providing a wax replica of the beam;
4 positioning the compressive and tensile
5 structural elements within the wax replica in portions

6 of greatest compression and greatest tension,
7 respectively;

8 casting the beam by adding liquid material to the
9 wax replica such that the liquid material replaces the
10 wax and the structural elements remain positioned in
11 the portions of greatest compression and tension.

1 96. The method of claim 95, wherein the positioning
2 sub-step is performed by subjecting the wax replica to
3 centrifugal force such that the centrifugal force
4 exerted on the compressive and tensile elements causes
5 them to relocate to positions along the cross-
6 sectional profile corresponding to portions of
7 greatest compression and portions of greatest tension,
8 respectively.

1 97. The method of claim 94, wherein the weighting
2 sub-steps comprise:

3 stringing the compressive structural elements
4 together along an axis parallel to their walls;

5 stringing the tensile structural elements
6 together along an axis parallel to their walls;

7 positioning the compressive and tensile

8 structural element strings in areas of greatest
9 portions of compression and tension, respectively; and
10 casting the beam around the compressive and
11 tensile structural element strings such that they
12 remain positioned in areas of greatest compression and
13 tension, respectively.

1 98. The method of claim 97, wherein the stringing
2 sub-step comprises welding the elements together.

1 99. The method of claim 97, wherein the forming step
2 comprises casting the beam after the positioning step.

1 100. The method of claim 97, wherein the forming step
2 comprises extruding the beam, and where the extruding
3 occurs simultaneous with the positioning step.

1 101. A method for fabricating a structural beam having
2 a cross-sectional profile, first portions of the
3 profile being in compression and second portions of
4 the profile being in tension due to a loading force,
5 the beam also having structural elements, each
6 structural element comprising a compressive and

7 tensile structural element, the compressive structural
8 element having a first enclosure having first walls
9 surrounding a first cavity, the tensile structural
10 element having a second enclosure having second walls
11 surrounding a second cavity, a first non-compressible
12 material disposed in the first cavity, and a second
13 non-compressible material disposed in the second
14 cavity, wherein the first walls are shaped such that
15 the loading force tends to compress the structural
16 element by a first deflection causing an amplified
17 second deflection of the first walls into the first
18 non-compressible material, exerting a first
19 compressive force against the first non-compressible
20 material, resulting in a resistance to the first
21 deflection and the loading force, and wherein the
22 second walls are shaped such that the loading force
23 tends to elongate the structural element by a third
24 deflection causing an amplified fourth deflection of
25 the second walls into the second non-compressible
26 material, exerting a second compressive force against
27 the second non-compressible material, resulting in a
28 resistance to the third deflection and the loading
29 force, the method comprising the steps of;

30 providing compressive structural elements of the
31 present invention;

32 providing tensile structural elements of the
33 present invention;

34 joining the compressive and tensile structural
35 elements to form the structural elements;

36 forming the cross-sectional profile of the beam
37 to a predetermined length; and

38 disposing a multiplicity of the structural
39 elements throughout the beam cross-sectional profile
40 and along its length.

1 102. The method of claim 101, wherein the providing
2 steps further include the sub-steps of:

3 fabricating the first non-compressible material
4 to a shape and size substantially similar to that of
5 the first cavity;

6 fabricating the second non-compressible material
7 to a shape and size substantially similar to that of
8 the second cavity;

9 forming the first enclosure having first walls,
10 around the first non-compressible material; and

11 forming the second enclosure having second walls,

12 around the second non-compressible material.

1 103. The method of claim 102, wherein the steps of
2 fabricating the first and second non-compressible
3 materials are performed by injection molding, wherein
4 the non-compressible material is an elastomer.

1 104. The method of claim 102, wherein the steps of
2 forming the first and second enclosures around their
3 respective first and second non-compressible materials
4 are performed by spraying a metal shell onto the first
5 and second non-compressible materials.

1 105. The method of claim 102, wherein the steps of
2 forming the first and second enclosures around their
3 respective first and second non-compressible materials
4 are performed by dipping the elastomer into a liquid
5 material bath which hardens to form a shell around the
6 first and second non-compressible materials.

1 106. The method of claim 101, wherein the providing
2 steps further include the sub-steps of:
3 forming the first enclosure;

4 forming the second enclosure;
5 filling the first enclosure with the first non-
6 compressible material; and
7 filling the second enclosure with the second non-
8 compressible material.

1 107. The method of claim 101, wherein the step of
2 disposing a multiplicity of the structural elements
3 throughout the beam cross-sectional profile and along
4 its length further includes the sub-step of weighting
5 the greatest incidence of structural elements in
6 portions of greatest compression and greatest tension.

1 108. The method of claim 107, wherein the weighting
2 sub-steps comprise:
3 providing a wax replica of the beam;
4 positioning the compressive and tensile
5 structural elements within the wax replica in portions
6 of greatest compression and greatest tension,
7 respectively;
8 casting the beam by adding liquid material to the
9 wax replica such that the liquid material replaces the
10 wax and leaves the structural elements in their

11 positions.

1 109. The method of claim 108, wherein the positioning
2 sub-step is performed by subjecting the wax replica to
3 centrifugal force such that the centrifugal force
4 exerted on the compressive and tensile elements causes
5 them to relocate to positions along the cross-
6 sectional profile corresponding to portions of
7 greatest compression and portions of greatest tension,
8 respectively.

1 110. The method of claim 107, wherein the weighting
2 sub-steps comprise:
3 stringing the compressive structural elements
4 together along an axis parallel to their walls;
5 stringing the tensile structural elements
6 together along an axis parallel to their walls;
7 positioning the compressive and tensile
8 structural element strings in areas of greatest
9 portions of compression and tension, respectively; and
10 forming the beam around the compressive and
11 tensile structural element strings such that they
12 remain in areas of greatest compression and tension,

13 respectively.

1 111. The method of claim 110, wherein the stringing
2 sub-step comprises welding the elements together.

1 112. The method of claim 110, wherein the forming step
2 comprises casting the beam after the positioning step.

1 113. The method of claim 110, wherein the forming step
2 comprises extruding the beam, and where the extruding
3 occurs simultaneous with the positioning step.

1 114. The method of claim 101, wherein the joining step
2 comprises welding the compressive and tensile
3 structural elements together to form a common wall.